DOCUMENT RESUME

ED 368 379 IR 054 946

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TITLE The Questions That They Ask.
PUB DATE [93]
NOTE 19p.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Communication (Thought Transfer); *Competence; Elementary Secondary Education; Foreign Countries; Futures (of Society); Higher Education; *Information Literacy; Information Management; Information Seeking; Knowledge Level; Literature Reviews; Needs Assessment; *Problem Solving; *Questioning Techniques; Recall (Psychology); *Skill Development; Test Construction; *Thinking Skills

ABSTRACT

This paper discusses the competencies that are required to work effectively with information. It examines the nature of the information resources and how students interact with them. The discussion moves to the types of questions students have asked and suggests that the predominant types may not be assisting students in developing information usage skills, thus not improving their mastery of a skill set such as that proposed by R. J. Marzano and R. W. Ewy (1989). Reviews of research have indicated that teachers often do not ask questions that require students to work with information resources, relying instead on questions that merely ask for the recall of knowledge. The challenge is for teachers to more frequently pose questions that encourage students to use the problem-solving approaches they will need in the world of the future. The rapid redundancy of information means that no institution can give its students all the knowledge they will need, but students can be given the skills to update and refine their knowledge. Two figures illustrate the discussion. (Contains 37 references.) (SLD)

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# THE QUESTIONS THAT THEY ASK

*For, as Socrates first exemplified and as Aristotle first taught, it is in questions and their answers that our knowledge consists.* (Dillon: 1983 p.24)

## 1. CONTEXT

As the focus of the workforce changes from "monkey see monkey do" training methods to methods where workers are encouraged to have an understanding of the processes that they are responsible for and are also invited to input to the organisation and running of workplaces there have been 'concerns expressed by educators, business leaders, and parents who have repeatedly asked for better thinkers, problem solvers and inquirers' (Breivik: 1991 p.29).

In addition to this change in training philosophy, there have also been changes in the delivery of training. Use of teaching styles that feature concepts of flexible and open delivery are being adopted within the technical and further education system as well as the university system.

Such styles place emphasis on the learner rather than the teacher. To successfully complete studies learners now need to be able to use resource-based approaches to learning. The resource-based approach has been defined in terms of the primary responsibility for transmission of information resting with the learner rather than the teacher (Burnheim and Floyd: 1992). Successful resource-based learning is dependent on students being able to work with information resources - they need to be information literate.

For learners to use the resource-based approach and thus to have skills appropriate for use during flexible and/or open learning activities, they will need to master various skills that may be grouped under the term of information literacy.

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From a research project conducted in 1992 (Burnheim and Floyd: 1992) it was established that this set of skills included being be able to:

- define information required for specific needs
- locate information resources available from a range of sources, and
- effectively and eificiently analyse the information.

The mastery of these skills will enable 'the individual to learn independently about any area of interest'. (Bruce: 1990 p.6) In other words, they are some of the skills required for learners to become independent, life-long learners.

Information literacy, as a skill area, should not be looked upon as discrete. Rather 'today's definition of literacy must include not just the ability to read, but also the ability to find and evaluate needed information so that the reader can function and work as a productive member of society. When all American citizens can make decisions based on information they have found and evaluated, then all of the other literacies will have also been achieved' (Breivik: 1991 p.29).

At present the push for the acceptance of information literacy as a necessary skill domain is in its infancy. In addition to those discussed earlier in this paper, what are some other forces supporting those promoting its place in the curriculum?

Employing organisations are challenging the education sectors to 'produce workers who are confident managers of information and, thus, better decision makers at all levels' (Breivik: 1991 p.29).

Reich (in Marzano and Ewy: 1989 p.28) suggests workers of the future will need not only specific trade of profession related skills, but also to have mastery of a set of more general abilities to enable them to become self-generating, critical and creative employees.

Marzano and Ewy (1989) provide a projection of the skills that they argue workers will need for today and tomorrow's workforce. Like Reich, they contend that workers will need to have broad base of cognitive skills that may be developed through vocational education.

The table below lists the skills that Marzano and Ewy (1989) discuss. As can be seen these are generic skills that are not tied to a specific trade or profession. However, all of the skills listed will be used by an information literate person as that person works with information resources.

| KNOWLEDGE EXTENSION SKILLS | | ENABLING SKILLS | |
|---|---|---|---|
| Class | Description | Class | Description |
| Composing | Creating a new product using known information | Comparing | Identifying the similarities and differences between two or more items of investigation |
| Problem solving | Obtaining a goal by overcoming some obstacle | Classifying | Grouping items into categories |
| Decision making | Selecting among alternatives that seem about equal | Deducing | Inferring unknown examples from a known principle |
| Scientific enquiry | Identification of the underlying principles of some phenomenon, making predictions based on those principles, and testing the accuracy of those predictions. | Inducing | Inferring unknown principles from examples of observation or analysis |
| | | Analysing errors | Identifying mistakes in your thinking or someone else's |
| | | Supporting | Offering facts and principles as evidence for a stated conclusion |
| | | Abstracting | Identifying the underlying principles and concepts for a specific set of information |

Fig 1: Marzano and Ewy Skills List (1989)

For these skills to be developed increased emphasis on the development of self-management and thinking-reasoning skills along with the traditional training in specific job skills will be required within the vocational education and training curriculum. This shift should be reflected in the learning activities that students are asked to undertake.

In the Australian context the Mayer Committee established a set of key competency strands. It was that Committee's expectation that all students completing post-compulsory education and training programs would master or learn a core set of competencies that would be appropriate for most work situations. (Committee to advise AEC and MOVEET on Employment-related Key Competencies for Postcompulsory Education and Training: 1992)

One of these strands is the collection, analysis and organisation of information. It focuses on the capacity to locate information, sift and sort information in order to select what is required. (Committee to advise AEC and MOVEET on Employment-related Key Competencies for Postcompulsory Education and Training: 1992 p.16).

A national survey of Australian literacy levels showed that in the sample studied '73% could not identify the main issues in a newspaper article on the implications of modern technology' (Morris and Brown: 1990 p.13). By definition, an information literate person will have the skills to work effectively with information such as this. 'Information literacy defines the ability of an individual to select and apply a variety of appropriate information skills and strategies in order to effectively handle information tasks' (Henri and Dillon: 1992 p.106). That person should have the skills to decompose the text and to identify those issues.

This paper discusses the competencies that are required to work effectively with information. It examines the nature of the information resource and how students interact with them. The discussion moves to the types of question students have been asked and suggests that those predominating may not be assisting students in developing information usage skills and thus improving their attainment and mastery of a skill set such as proposed by Marzano and Ewy.

## 2. THE COMPETENT USER OF INFORMATION

If one of the aims of vocational education and training is to provide graduates who are confident managers and users of information, it will be necessary in the current climate of the competency-based training curriculum to identify those competencies that will need to be achieved to meet this aim.

The Mayer Committee has suggested that as part of their education students should be provided with the skills then will enable them to collect, analyse and organise information. (Committee to advise AEC and MOVEET on Employment-related Key Competencies for Postcompulsory Education and Training: 1992 p.16). This statement provides a broad indication of the direction that that Committee recommends should be followed.

Marland, quoted in *Information Skills in the Secondary Curriculum* (Schools Council Curriculum Bulletin 9, Methuen Educational, 1981) suggests that when working with information there are nine questions steps than should be followed. These steps are restated below as competencies; a basic description of each follows:

*The student can:*

*Formulate and analyse an information need.* The student can state clearly and concisely the information required to answer a question or to solve a problem. Achievement of this competency enables students to set the directions and parameters to be used for the collection of information.

*Identify and appraise the worth of likely information sources.* Libraries are not the only source of information. Students must be aware of the range of sources of information and have an understanding of the types of information that they provide.

*Trace and locate individual resources.* Students must be able to locate resources using common tools such as indexes, directories, catalogues and database management systems. The student must be aware of the range of media that can be used to deliver information. This includes human resources as not all information is held in print and non-print media.

*Examine, select and reject individual resources in the light of the information need.* When interacting with an information resource, criteria to indicate the potential usefulness of the resource, related to the information requirement, need to be understood and applied. Such criteria include bias, recency, authority and sophistication.

*Interrogate resources to isolate required information data.* In the majority of cases a student will not be expected to use an information resource in its entirety. Rather they will be expected to locate within the information resource the information data that is required to meet the information need. Deconstruction skills such as the understanding and usage of structural analysis techniques are required to achieve competency.

*Record and store information data.* To effectively interact with information resources, isolate and extract information data, the student needs to be able to use organisational methods that enable coherent recording and storage. By achieving competence, the creation, or construction of an information resource by the student will be helped.

*Interpret, analyse, synthesise and evaluate information gathered.* Not all information data gathered, while relevant to the information need, will be used in the creation of the student's information resource. The student needs to be able to compare, contrast and select the information most appropriate to the need. This will include the testing of claims and identification of supportive information data.

*Present and communicate findings.* Once the information data has been complied into an information resource, the student can select the presentation and communication mode most suitable for the particular situation. This will require multimedia competency and understanding of the use of delivery techniques based on differing sensory modes.

*Evaluate the conduct of the process.* At the completion of the activity the student can view the process as executed and is able to evaluate the activities carried out in each of the previous areas. This is a critical competency. For the student to have control over their learning, i.e. to become an independent lifelong learner, that student must recognise those areas where they have not achieved full competence and to set goals to increase their competency in that particular area.

In her work Gawith (1991) compresses these nine steps into six stages: deciding, finding, using, recording, presenting and evaluating. She ties working with information to action learning and describes the purpose of action learning is

'to give control of the learning process to the learner' (Gawith: 1991 p.14). This is quite similar to definition of resource-based learning given earlier.

Devine (cited in Deese 1986) also suggests six competencies - acquiring, recording, organising, synthesising, remembering and using. These are more aligned to the specific nature of information processing rather than to the wider scheme of Marland. For example, Devine does not list definition of information need or evaluation of the working with information process. However, when comparing Devine with Marland it can be argued that Devine's competencies can be identified within Marland's and therefore can be classed as a subset.

While this provides a statement of the competencies required to effectively work with information, neither Marland, Devine or Gawith discuss the nature or structure of information.

## 3. THE NATURE AND USE OF INFORMATION

Ouwersloot, Nijkamp and Rietveld state that 'much has been written about information, but seldom has information been defined in an operational sense' (1991 p.171). They examined the nature of information and addressed its use from an economic perspective. Of interest here is their identification that within the various definitions of information analysed they found the use of three concepts of data, information and knowledge to be common.

They suggest that this indicates a non circular sequence of data, information and knowledge and that this can be used to describe how information resources are created and used (Ouwersloot, Nijkamp and Rietveld: 1991 p.171).

Based upon their discussion, the following structural analysis may be developed. In a latent state, information exists as a number of data elements. These elements may have some form of interrelationship or interrelativity but their

organisation is such that this is not apparent.

By imposing some form of coherency, i.e. logical structure, to these data an author, for instance, will create an information resource. A definition of such being a number of information data that have been organised coherently.

Information resources are then used to develop and increase knowledge. The resource stage is static, while the actual use of the resource is dynamic and responsive to the learner's needs.

This provides a broad view of the nature of the information resource. Previously a listing of the competencies required to work with information was provided. How do the two concepts link?

In both cases, the structures described have been flat and serial. Using Ouwersloot, Nijkamp and Rietveld's sequence as a base a model of use may be developed. The underlying expectation is that as required learners will seek information resources that may provide information about a topic. They will work with these resources, selecting the data required and use this data to increase, develop and/or refine their knowledge.

The three concepts of data, information and knowledge form the central trunk. In interacting with the information, the competencies described earlier will be used.

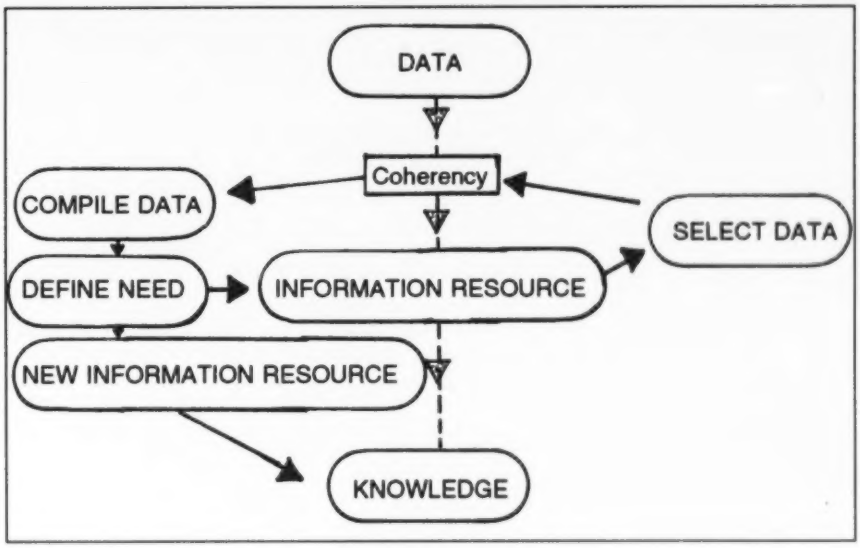


Fig 2: Interaction with Information

The learner interacts with this model in the following way. An information need is defined by analysing a question or problem and identifying a type of information required, for example information listing attributes, information detailing the effect of some action, information about how to solve a problem, or information that can be used to compare one or more cases of some concept or topic.

Information resources are then identified that may provide the information required. These resources are interrogated and information data that matches the need is located and evaluated for worth. The user assembles this data, hopefully in a logical, coherent manner, and when there is sufficient information to meet the information need, the user creates an information resource. This resource being a coherent gathering of data from several other information resources that addresses or meets a defined information need. The user then uses this new information resource (that they created) to increase their knowledge.

During the interactions, other knowledge is being developed as well, for example what are proving to be good sources of information, which resources are proving to be most useful for this type of task, what organisational patterns are being used to provide structure to the data. Wiggins states that 'research papers are assigned with a hope that students will discover the variety of resources available, broaden their understanding of the topic and learn to select and to apply information most appropriate to their needs' (1992 p.73).

Of prime importance through the process is that the student understands the process that they are using to meet their information need. Bruce suggests that by understanding the process 'not only do students mature in their understanding of how information is organised, they become relatively independent in their ability to retrieve information of value to them' (1990a p.227).

This maturation and independence would be able to be accomplished by ensuring that the student is given the opportunity to step back and gain an overview of the processes being used. By doing so the transferability of the process should be observable and discussed and with this knowledge and understanding, the student may gain the confidence to apply the process to other areas. Breivik states that 'people need more than just a knowledge base, they also need techniques for exploring it, connecting it to other knowledge bases and making practical use of it' (Breivik: 1991 p.29).

As Gawith (1991) suggests, by using these processes the student becomes involved in action learning where they have greater responsibility for completing learning activities. 'People acquire information literacy abilities through a process that moves from passive to active learning. This transition is accomplished by having students assume more responsibility for locating and accessing the material on which they will base their learning' (Breivik: 1992 p.9).

In considering the way information is used and interacted with it becomes apparent that this is both a manipulative and cognitive process. (Henri and Dillon: 1992) Users of information resources must have the ability to find the physical resource and then have the skills to be able to deconstruct the resource, identify information data pertinent to their needs and to reconstruct the data into the new information resource.

In doing so, the challenge today rests not with the scarcity of information but with its abundance and the management of its use (Farmer: 1992).

'Students who do not think, copy extracts from one or two texts and rewrite them as part of their own work. Students who think, investigate, analyse and synthesise views expressed in many information sources.' (Henri and Dillon: 1992 p.115)

## 4. THE ROLE OF THE QUESTION

This paper began with a discussion of the need for workers to achieve a higher level of cognitive skills than they have been achieving through current training. A range of general skills, not tied to any one trade or profession were identified. A number of these were collected under the umbrella term of information literacy. It was suggested that by achieving information literacy the worker will be better prepared to make decisions, analyse where problems are occurring and to suggest possible solutions.

Effective and efficient use of information requires the user to be able to identify information needs and to be able to retrieve information that will meet those needs. In most cases the information will be sought to answer a question, to complete a task that has been set. If students are to develop information literacy, then the questions that are posed to them should be such that they will encourage students to work with information resources rather than to rely on

what they may have been told during class or have read from the set text. The questions should stimulate the student to explore the available information and to sift through it, finding that which is appropriate to the question being addressed.

There have been various taxonomies proposed to analyse the nature of questions (Barrett in Shake: 1988, Pearson-Johnson in Shake: 1988, Dillon: 1983, Bloom in Kloss: 1988, Costa in Pizzini Shepardson and Abell: 1992; and Armbuster and Ostertag: 1989). In most cases the schemes categorised questions from a low of those requiring only recall of information with very little processing or interpretation, usually from one source, to a high of those requiring the location of information, evaluation of its quality, the analysis, synthesis, compilation of information from various sources.

Hoxmeier (1986) reports that, historically, studies have revealed teachers consistently ask questions that would be categorised at the lower end of the scale, mostly dealing with recall of learnt facts. In 1912 Stevens (in Hoxmeier: 1986) found that 66% of questions asked by high school teachers only required direct recall of information. The questions did not encourage students to look for information, they could be answered on that passed on during class. Another study conducted in 1935 by Haynes (in Hoxmeier: 1986) showed that only 17% of questions put by History teachers would require the student to think about the answer, the remaining 77% only required recall of a fact previously taught. In 1940 Corey (in Hoxmeier: 1986) reported that 71% of questions asked in high school classes were found to only require factual responses.

Hoxmeier found very little evidence that questions asked would require students to work with information resources to find answers. She states that 'we must break this historical clinging to the lowest level of information processing' (1986 p.6).

Other studies also show similar data. Shake (1988) used Barrett's taxonomy to analyse questions put to students. She found that 52% of questions required

very little thought in answering. Most could be answered by recognition and recall of a fact. Less than 24% of questions required the answerer to evaluate or judge the information before providing the answer. Shake (1988) also used the Pearson-Johnson taxonomy to examine the same questions. Using this taxonomy, only 19%of the questions would require students to work with more than one information resource to provide the answer. In both cases, questions only required basic information skills to answer them. The challenge to the students was minimal.

In his study, Dillon (1983) found that 76% of the questions examined could be answered by fact stating and/or explaining. Very few encouraged the student to define, interpret, state an opinion or justify a response. Kloss (1988) used Bloom's taxonomy to analyse questions put to students. He found that 93% of questions posed could be categorised within Blooms two lowest domains - knowledge and comprehension. The were few questions that required students to work in the higher cognitive domains of analysis, synthesis and evaluation.

Using Costa's three stage model, Pizzini, Shepardson and Abell (1992) found that 78% of questions analysed could be answered by recall of information from the memory or senses. Only 14% would require an answer developed form the drawing of relationships among data and a meagre 6% challenged the answerer to use the data collected in new ways through hypothesising, speculating and generalising.

Armbuster and Ostertag (1989) report on a study conducted by Trachtenburg that produced a profile of 63% questions requiring little of no inferencing, mostly requiring only recall of information presented in the text and 36% requiring minimal inferencing, perhaps drawing on two or three texts, but with little expectation of interpretation or making of value judgements.

## 5. INFLUENCE OF QUESTION TYPES ON INFORMATION USAGE

It is apparent that, to date, the questions being asked of students have not encouraged them to use a variety of information resources, to examine the information provided in each, to evaluate the quality of the information and to draw various data together to provide the answer. Most have only required a regurgitation of facts with little manipulation by the answerer.

Breivik suggests that 'people whose education largely consists of lectures, textbooks and reading lists are not well prepared for problem solving in the complex world in which they must work' (1992: p.7) A change is therefore indicated in the questions that students are being asked to answer in assignments and complete during workshop lessons. By doing so information literacy skills may be developed. Breivik continues by challenging teachers to require greater use of information resources '. . .when faculty require students to use a variety of information resources as part of class assignments . . . students receive the message that the ability to locate, evaluate and effectively use information is critical to learning' (Breivik: 1992 p.10).

The challenge is for teachers to more frequently pose questions that encourage students to go beyond the information presented in class, at lectures and to put the students into the situation where they will have to work with the information they are using. The students will need to become responsible for the management of the information's location, and evaluation of its quality and appropriateness to the task at hand. By doing so they will acquire a skill for life-long learning, a skill that will help them cope with the changing nature of workplace information.

The way in which information is handled will be a major determinant of the way in which people live, work and communicate and will be increasingly important to the quality of life in the future. By changing the types of questions asked, the student will be encouraged to become a worker with and user of information and

thus be better placed to understand the nature and functions of information and its impact on the contemporary world.

This challenge will not be met without some trauma and it certainly will not occur overnight. Development and redevelopment of questions will be time consuming and frustrating. 'A curriculum innovation such as information skills requires the teacher to take on new roles and threatens his or her identity by asking for new kinds of functions, sometimes on the margins of the teacher's intellectual discipline' (Hounsell and Martin: 1983 p.56).

How well do teachers understand the power of the question? Do they have the skills and knowledge to unleash these powers? To date the answer, based on evidence available is not positive. Why do teachers rely on low level questioning techniques? Clearly there is a continuing education, professional development requirement so that practising teachers can have the chance to develop and hone their questioning skills.

Students may also be a little concerned if the questions that they are now being asked do not have obvious, easily found answers. 'The very idea that students need to identify, select, evaluate and organise information for use in the classroom is unsettling and threatening to many' (Farmer: 1992 p.111). To counter this students will need to be give opportunities to explore and understand the working with information processes and be able to apply them over a range of situations. They will need to examine the nature of information and understand how it is structured so that they are able identify the data appropriate for their needs.

Both teachers and students will need to achieve competence in each of the nine areas of information usage. By consciously choosing to ask questions that will encourage the use of information resources and by developing information literacy skills the concerns expressed for better thinkers, problem solvers and inquirers may be addressed.

## 6. CONCLUSION

In preparing students to enter the workforce of tomorrow, many challenges exist. The rapid redundancy of information is fact. No educational institution can hope to give their students all the knowledge that they will ever need. What they should provide is the skill set through which students can continually update, refresh and refine their knowledge. By asking questions that encourage the exploration of information in preference to those that require a regurgitation of facts and by developing competencies in the use of information this will be partially achieved.

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